

A Study of 3D Object positioning on Google Earth by using OpenGL Fusion and Augmented Reality

Hideo Miyachi¹, Yuichi Uetake², and Shunji Ido²

¹Cybernet Systems CO., LTD., Japan

²Department of Information Systems, Faculty of Engineering, Saitama Institute of Technology, Japan

Abstract—We have been studying about the method to create active contents consist of multiple application programs in virtual reality system (VR). To combine active applications into a virtual world, we use OpenGL fusion technology. In the case, the positioning issue comes up. We have acquired AR(Augmented Reality) technology to solve the problem. In this paper, we introduce the study of the method.

Keywords— Virtual Reality, OpenGL Fusion, Augmented Reality

1 Introduction

We reported a system in which multiple active programs collaborate in a 3D virtual world in JSST2011 [1]. In the report, a clock program and rocket program worked in cooperation with their communication through a socket. Both 3D graphics generated by each program were shown in Google Earth world by using OpenGL fusion technique (Fig.1)

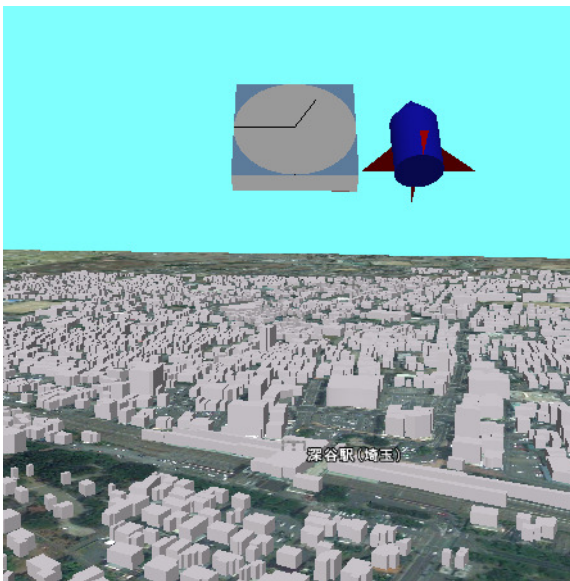


Fig.1 Virtual world in which three kinds of programs: clock, rocket and Google Earth, are working

In Fig.1, the clock and the rocket are placed in an air. Because it is difficult to put them correctly in a specified location. This is due to the mechanism of OpenGL fusion. We are studying to solve the difficulty by using AR (Augmented Reality) technique. In this paper, we describe the summary of the trials.

2 Related Work

AR is a well-known system to overlay computer graphics in a movie captured by a video camera in real time. To use AR system and OpenGL Fusion, we have succeeded put a tree by Google SketchUp on AR marker placed in a computer graphics scene (Fig.2)[2]. In this case, AR marker was placed on a suitable place by manual operation. The size of tree was also adjusted to a suitable scale by manual.

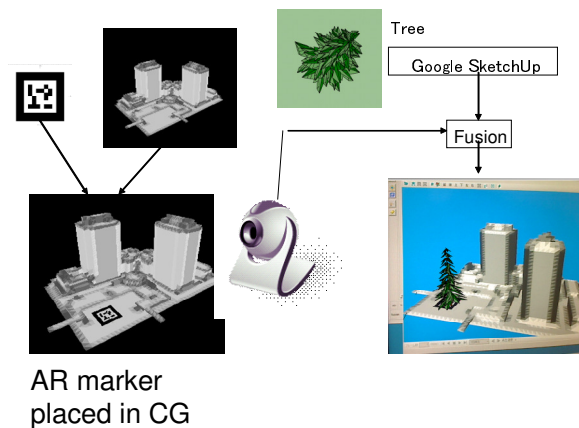


Fig.2 Arrangement of a tree on AR marker

The study in this paper aims to make the suitable operations sure in Google Earth.

The objects modelled by Google SketchUp can be arranged on Google Earth easily by using SketchUp function. But our goal is to arrange any 3d object and active object generated by any OpenGL program in real time.

3 Method

We planned the method in following procedures.

- (1) Arrangement AR marker on Google Earth
KML supports ground overlay function. AR marker can be arranged on the ground in latitude-longitude coordinate system. Then, the image should be arranged in only latitude-longitude grid.
- (2) Rotating AR marker to a specified angle.
To arrange the marker to arbitrary direction, AR marker should be rotated. This is a difficult step. When we built a house in front of a load, nobody knows the angle of the load. We obtain the angle calculated from two point position by clicking on Google Earth.
- (3) Calculating the size of AR marker in meter.

In general, 3d objects are designed in meter unit. We need to know the size of AR marker in meter. Theoretically, we can convert the size from in latitude-longitude to meter. However, we have to know the scale of AR marker in a projection coordinate in Google Earth

Through step (1) to (3), we have to put 3d objects on Google Earth correctly.

4 Result

One of the results is shown in Fig.3. A visualization result, iso-surface of magnetic field and lines of magnetic force, are arranged on an AR marker over a map by Google Earth. The objects come from AVS/Express visualization application software in real time. An animation of particle tracing to express magnetic force is shown in the scene.

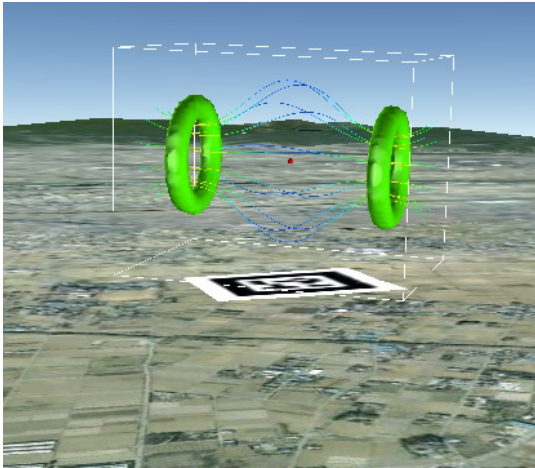


Fig.3 Visualization 3d graphics arranged correctly in Google Earth

5 Conclusion

We have proposed a method to arrange 3d objects captured by using OpenGL technique on Google Earth correctly. We think that the method contributes a disaster simulation visualization like Tsunami .

References

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